select the same or similar dyestuffs. It is also a desideratum for the merchant or textile manufacturer to be able to ascertain whether the colour of the materials dyed for him is always obtained with the dyestuffs specified, whether the shade dyed by one firm is or is not a chemical match for that dyed by another, and other similar questions. The analytical chemist is also frequently called upon to determine the actual dyestuff or dyestuffs employed, for example, in the composition of a lake pigment for wall-papers or lithographic printing, or to identify the material used for colouring certain food products.

With the large number of dyestuffs which come into consideration it is obvious that no satisfactory scheme of identification can be based upon individual and empirical reactions, such, for instance, as the changes of colour produced by caustic soda or concentrated sulphuric acid. Such individual tests can only be employed effectively after the genetic relationships of the dyestuff in question have been ascertained by means of suitable group reagents; and only those chemical properties can be employed as group reactions which depend upon general differences in chemical structure. Another reason why such a principle can alone prove satisfactory is that the scheme adopted must be capable of including and referring to their appropriate groups the new colouring matters which are constantly appearing, the individual reactions of which are unknown.

In the analytical scheme published by A. G. Green in 1893, which is based in part upon the earlier schemes of Witt and Weingaertner, the chief differentiation is effected by the behaviour of the dyestuff upon reduction with zinc dust, and the reaction of its reduction products with air and with chromic acid. Whilst nitro-, nitroso-, and azo-compounds are completely broken down upon reduction, and cannot therefore be reoxidised, those dyestuffs which may be regarded as having an *ortho*-quinonoid structure give leuco-compounds which are readily reoxidised to the original dyestuff by air, and those to which a *para*-quinonoid structure is attributable give leuco-compounds stable to air but reoxidised by chromic acid. Still, a further group are not reducible at all, whilst dyestuffs of the anthracene class are converted into coloured hydro-derivatives.

In 1905 and 1907, Green, assisted by Yeoman, Jones, Haley, and Stephens, published a very complete scheme for the analysis of dyestuffs upon textile fibres, in which the above principles were employed in conjunction with other group tests. In this scheme sodium hydrosulphite was substituted for zinc dust as the reducing agent, and the colourless potassium persulphate for chromic acid, all the reactions being effected upon the fibre instead of in solution. This scheme of analysis is not only applicable to dyed materials, but can also be readily applied to colouring matters in the solid form or when associated with mineral bases, food products, &c., by previously transferring the dyestuff to wool or cotton.

In the work under review the author claims to have produced a perfected scheme of analysis of general applicability. In place of employing group reactions to differentiate the dyestuffs according to their structural relationships and dyeing properties, the system adopted is largely empirical, being based upon the exact determination of colour changes effected by various reagents, the shades obtained being compared with standard shade cards and the results tabulated by a system of lettering. Although Green's reduction and oxidation tests are also employed as "generic" reactions, their indications are interpreted in a strictly formal manner under arbitrary but rigidly fixed conditions. This produces the result that the main groups or "genera" frequently contain dyestuffs which are entirely unrelated. We find, for instance, azo-colours of the benzopurpurine type classified together with rhodamine (a pyrone colour); phosphine and other acridine colours classified with annatto; auramine (a diphenylmethane derivative) in association with primuline (a compound of the thiazol class); various alizarine colours in close conjunction with rose Bengal and violamines (pyrone colours); and dyes of the azo-class, triphenylmethanes, and natural red woods amongst the azines, oxazines, and thiazines. The author's system also involves the coordination of dyestuffs of entirely different dyeing properties, irrespective of whether they are "basic," "acid," "substantive," or "mordant" colours.

The book contains colour reactions of some 1475 individual dyestuffs, which are recorded with extreme precision for the selected conditions. Although, however, it has involved much careful labour, the utility of the work has been largely sacrificed to the desire to obtain an impossible degree of accuracy and through the unscientific and inconvenient system of differentiation adopted. Such a rigid system of colour reactions does not take account of the fact that commercial dyestuffs usually contain variable impurities or are shaded with small quantities of other colouring matters. Furthermore, it may be questioned whether the exact tint obtained in the tests would not be also affected by small indeterminate factors, such as the purity of the reagents or the quality of the textile materials used in dyeing. Lastly, the scheme could not be applied to mixtures without a complete separation into the constituents, a condition which is seldom possible.

ARTHUR G. GREEN.

MUNICIPAL ENGINEERING.

A Manual of Civil Engineering Practice: Specially arranged for the Use of Municipal and County Engineers. By F. Noel Taylor. Pp. xii+809. (London: C. Griffin and Co., Ltd., 1911.) Price 25*s*. net.

THIS book has been written to supply the needs of young engineers who propose to devote themselves to those branches of engineering practice which fall to the lot of the municipal and county engineer, or the borough surveyor; the duties which have to be undertaken by such officials are of a most varied character, and involve a wide range of knowledge; books of reference are essential to such men, and Mr. Taylor, drawing largely upon his own professional experience, has dealt with the entire field of work covered by the term "municipal civil engineering."

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The first six chapters are devoted to surveying and levelling, and the mensuration of earthworks, the subject being treated with special reference to the class of work which has to be carried out by municipal engineers, such as the laying out of roads, tram-lines, sewers, &c.; next follow three chapters dealing with such general problems as the stresses and strains in beams and struts under given loading, and the methods of determining the necessary scantlings of simple beams and pillars. In a special chapter on the various materials employed in constructional work, the author gives a concise description of their structure, essential properties, manufacture, and the usual methods of testing them to ensure soundness and freedom from all defects. Retaining walls and their design are fully discussed in chapter xvi., and examples are worked out to illustrate the use of the formulæ and the methods of securing safety with economy of material.

The making and repair of roads form a very important part of the duty of a municipal engineer: prior to the advent of the motor-car, the roads outside town areas had been much neglected, and they were in a totally inadequate condition to deal with fast and heavy traffic; as a consequence the questions of road maintenance and road construction have entered during the past ten years upon an entirely new phase. To mention only one of the changed conditions, with horse traffic the dust nuisance was, in country districts, a matter of slight importance; at the present day, on roads on which there is a heavy motor-car traffic, the suppression of dust becomes a factor which must be dealt with, and to which other details may have to be subordinated. In chapter xix. the author gives an excellent abstract of a report upon the proceedings of the International Road Congress, which met in Paris in 1908, prepared for the Local Government Board of Ireland by the chief engineer, Mr. Cowan. This congress agreed to a series of resolutions embodying the views of the delegates as to the lines upon which in the future roads should be constructed and maintained, and also as to how best to cope with the dust problem, though at present opinion is divided as to the respective merits of surface tarring and tar-macadam.

A valuable chapter is that devoted to the design of structures in reinforced concrete; some excellent notes are given as to the essential qualities of the two materials employed—the concrete and the steel—then a series of simple formulæ is worked out, and, finally, typical illustrations of design are given, such as floors, piles, reservoir walls, bridges, and sewers, in each case attention being directed to practical difficulties which have to be met and overcome, if thoroughly sound, durable work is to be produced. This chapter is appropriately followed by one on masonry road bridges and similar work.

The problem of the removal of domestic and trade refuse, solid and liquid, is dealt with in six very complete chapters—one of the best sections, in fact, of the book. All the most modern and efficient methods are discussed and explained, both in regard to the laying out and the construction of sewers, and in regard to the ultimate treatment of the sewage at the outfall works. An abstract is given of the report of the Royal Commission on Sewage Disposal of 1908, a report which embodies the views of chemists, biologists, and engineers, and is a storehouse of information upon a subject which is of vital importance to the general public, and the layman is as much concerned with the efficient solution of this knotty problem as the engineers who have to design and maintain the necessary works. To make this section of the book complete, the author has added a chapter on the ventilation of buildings and house drainage, in which the best types of modern sanitary house fittings are described, with the help of a series of good illustrations.

Waterworks, their design and maintenance, form the subject of three chapters. Full details are given of the best system of filtration, of methods of softening hard waters so as to render them more suitable for domestic purposes, and of detecting and checking waste of water, a constant source of worry to the engineer in charge of such works; some figures are given to show how excessive this waste by leakage and by the culpable negligence of householders may be, and how important it is to put a stop to it, if needless expense in constructional works is to be avoided, and a shortage of supply in periods of drought prevented.

Constructional steel work is discussed in a very complete chapter. The examples chosen cover a wide range of such class of work—overhead water tanks, roofs, and bridges of various type. The illustrations in this chapter are clear and not overburdened with detail, and are, therefore, much more likely to prove useful to a designer who consults them than is often the case with plates reproducing engineering drawings. For the guidance of young engineers, Mr. Taylor has given a special chapter to the subject of the preparation and drafting of specifications, a chapter which will no doubt be constantly consulted, as it is full of the most useful hints and advice.

Mr. Taylor is to be congratulated on the production of a book which will find a place on the desk and in the drawing office of every civil engineer, and the publishers, too, must be given a word of praise for the excellence of the numerous plates and woodcuts.

T. H. B.

CHEMICAL PHENOMENA OF LIFE.

Chemical Phenomena in Life. By Prof. F. Czapek. Pp. ix+152. (Harper's Library of Living Thought.) (London and New York: Harper and Bros., 1911.) Price 2*s.* 6*d.* net.

MESSRS. HARPER could not have secured a more authoritative or a clearer writer than Prof. Czapek, of Prague, to present to the public the most recent views of biochemistry. The chemistry of protoplasm and its behaviour, as well as that of its constituents, have been greatly illuminated since that branch of chemistry known as the chemistry of colloids has been subjected to investigation. The main properties of colloids were discovered by Thomas Graham in 1861, and the conception of ions we owe to Faraday. Nevertheless, the science of physical

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